TITLE OF THE INVENTION

Aluminum Foil Cups for Covering Laboratory Vessels

CROSS REFERENCE TO RELATED APPLICATIONS

N/A

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

N/A

FIELD OF THE INVENTION

This invention concerns disposable coverings for laboratory containers, vessels, implements and the like. Laboratory containers typically include test tubes, flasks, beakers, vials, graduated cylinders and other vessels that have at least one opening for inserting and removing laboratory implements such as pipettes, magnetic stirring bars and the like, or laboratory materials such as chemical reagents. Disposable barrier materials for covering such containers include stretchable thermoplastic films such as Parafilm® (American National Can, Inc.) as well as household aluminum foil. The present invention is intended to facilitate the use of aluminum foil as an inexpensive heat-resistant and solvent-resistant covering, as well as sterile barrier material for laboratory containers.

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Express Mail Number
EV644485794US

Perlman in U.S. Pat. No. 5,302,344 describes the use of plastic-coated aluminum foil sheets that are useful in the laboratory to form a variety of shaped covers and containers. These sheets may be sterilized by steam-autoclaving or gamma-irradiation.

The use of regular household aluminum foil as a laboratory wrapping material is known to most laboratory workers, and is also described in the above referenced Perlman patent. This reference is incorporated herein in its entirety. Regular aluminum foil as commercially sold on a roll is non-sterile, and provides a heat-resistant and solvent-resistant covering material for laboratory containers. Subsequent sterilization of such containers with their aluminum foil coverings is a common procedure and is typically accomplished using either dry oven baking or steam-autoclaving.

There are no references in the patent literature, scientific literature or on the Internet that describe preformed aluminum foil cups that are adequately compliant (finger-formable) to be utilized as coverings for laboratory containers. The closest prior art appears to be disposable semi-rigid, but bendable, aluminum dishes used as containers for weighing chemicals (also optionally used as dust covers). These dishes are advertised in the Fisher Scientific Catalog, 2004-2005 edition (page 111), and are described as "aluminum weighing dishes" and "aluminum dishes with fluted sides." Applicant has learned from the manufacturer that these dishes are at least 3-4 mils thick

(0.003-0.004 inch), and others are considerably thicker. In fact, Applicant has determined that an aluminum cup whose wall thickness exceeds approximately 2 mils is too stiff to be either widened, or compressed to a smaller diameter with the users fingers (i.e., they are not "finger-formable") to a friction fit around a laboratory container. Accordingly, aluminum sheet material having a thickness of 2.5 mils and greater is excluded from Applicant's definition of aluminum foil and is not useful in the present invention.

SUMMARY OF THE INVENTION

This invention relates to the laboratory use of preformed, and finger-formable (i.e., re-formable), aluminum foil cups, similar in appearance to those cups with vertical sidewall pleats that are used for baking muffins and cupcakes. Pleated round foil cups, for example, are usually manufactured as a stacked group, each foil cup being interleaved with a paper liner sheet, allowing the cups to be easily separated from one another at the time of use. The manufacturing process for the foil cups described herein is similar to that used for foil bakery cups by Reynolds Consumer Products (Alcoa Company, Richmond, VA), except that the present invention requires that the commonly used lubricant placed on the cup-forming tooling surfaces, e.g., edible cocoa butter, be eliminated. Instead, a release liner paper is placed between the foil and the die to reduce any excessive frictional forces that could tear the foil. This substitution is important so that essentially no foreign

materials (such as the cocoa butter) will be found on the foil. Foreign materials could be transported or leached from the foil surface and contaminate a sample held inside a laboratory container that is covered by the foil cup. Even if such a lubricant were only placed on the outside surface of a foil cup, it is possible that contact between multiple stacked cups could move some of the lubricant from the outside of one cup to the inside (interior) surface of another cup.

According to the present invention, following their fabrication, the stacked foil cups are hermetically sealed, e.g., sealed in a plastic sleeve or in a shrink-wrap, and sterilized, preferably using gamma-irradiation. For use of the foil in the laboratory as described herein, the foil cup is inverted and placed over a laboratory container opening as a cover or cap. Preferably, the cup is squeezed or compressed by hand, to a friction fit around the neck or mouth of a container, thereby providing a snug closure over the laboratory container.

Applicant has found that the conventional laboratory means for handling and cutting regular aluminum foil (e.g., commercially available in 12 inch wide rolls)that is used as a covering material on laboratory containers, is awkward and time-consuming. More specifically, the laboratory worker is usually faced with the awkward task of either manually tearing or scissor-cutting aluminum foil into many swatches (i.e., typically flat square portions of the foil) to be used as container covers. Handling the individual pieces of foil that are initially chemically clean, without

contaminating them is also cumbersome. Then, to form a covering for a container, the swatch must be placed more or less symmetrically over a container opening and hand-shaped to conform to the outer contour of the container. Until the covered container is sterilized (by baking or steam autoclaving), the foil covering remains non-sterile.

While, in theory, it would be possible for a laboratory worker to hand-form and pre-sterilize foil container coverings without an accompanying container, this is not routinely done in the laboratory for several reasons. Shaped foils tend to be awkward to handle without being crushed, particularly conventional foils useful in the present invention (generally less than 0.002 inches thick, and more typically 0.0005-0.001 inches thick). Furthermore, if pre-sterilized, each foil item would need to be pre-wrapped to remain sterile after baking or autoclaving. This would be cumbersome, inconvenient, and wasteful of materials and space.

On the other hand, commercial aluminum foil baking cups are fabricated in a compact format and are space-saving, usually being fabricated in a stack, i.e., "piggy-back" fashion, 10-20 per group, with a paper interleaf between each cup in the stack. These single stacks are further combined (in an extended or taller stack) and box-packaged. Foil baking cups are currently fabricated in sizes ranging from approximately 1.0-3.5 inches in diameter. These cups are generally formed and die-cut in a combined operation in which the amount of foil used for

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each cup can be measured from the diameter of the round disc from a flattened foil cup. These disc diameters range from approximately 2.5-5.5 inches in diameter.

For the purposes of the present invention, the stacked cups are preferably hermetically sealed, e.g., wrapped with a thermoplastic film and heat-sealed to exclude contaminants. Subsequently, the foil cups with their interleaf paper liner sheets may be sterilized using ethylene oxide gas or preferably gamma irradiation. For gamma irradiation, a 20-50 kilograys exposure to Cobalt-60 radiation would be typical to assure product sterility. When sterile, the foil cups provide convenient dual use in both sterile and non-sterile applications as laboratory container covers.

To facilitate laboratory use, a stack of the chemically clean and preferably sterile foil cups is arranged as an inverted stack (bottom upward) because the cup, as a covering, is applied to a container in this inverted orientation. Additionally, the critical inside surface of the foil cup that will face the interior of the sterile container will remain sterile with the cup inverted.

Regarding the paper interleaf sheets that physically separate the foil cups, these sheets provide additional utility, which they do not provide when the cups are used as baking cups. That is, in the present invention, the foil cups and paper liner sheets are both rendered sterile, or if not sterile, are at least free of chemical

contaminants because of the clean "hands-off" manufacturing process. Therefore, each paper liner sheet serves as either a sterile, or at least a chemically clean, protective barrier against contamination of the interior surface of the cup. The sheets allow individual foil cups to be manually pulled from the stack one at a time (together with the sterile paper liner inside the cup), with the sheet facilitating handling and preventing contamination of the cup's interior surface. Thus, the paper interleaf protects the foil cup until it is separated from the paper and mounted upside down as a closure over the laboratory container (e.g., over a test tube, flask or beaker).

Also, in contrast to the bakery use of these foil cups, the vertical pleats around the perimeter of the cup are useful for facilitating the partial collapsing of the cup inward (to establish a frictional fit), or alternatively, facilitating the stretching of the sidewall of the cup outward to fit the outer diameter of the container. Thus, the foil cups serve as compliant, and inexpensive container coverings that are free of contaminants (or sterile), solvent-resistant, heat-resistant and disposable. As a technical matter, while pleats have proven to be a very practical means for accommodating the surplus area of foil that is produced when a cup is formed from a flat foil sheet, it is possible to use other surface treatments to accommodate the surplus foil. For example, surface dimpling of the foil can be

used to produce concave and/or convex areas on the sidewall of the cup that take up the extra foil area. In addition, any of a variety of other foil-accommodating means including crinkling of the foil can be used during the cup-shaping process.

Household aluminum foil and heavy duty aluminum foil that are currently available for use in chemical and biological laboratories typically range in thickness from approximately 0.0005 inches to 0.002 inches (0.5 to 2 mils thick). While aluminum foil is usually provided in a 12 inch wide roll and dispensed from the roll, as described above, it is often necessary to tear or cut the foil into smaller square portions for various uses. This handling and cutting can be awkward and time consuming, and often results in the aluminum foil becoming contaminated by hand contact, or by contact with dirty scissors, and the like. Alternatively, if multiple foil sheets are stacked and cut simultaneously by scissors to save time, Applicant has observed that the resulting sheets are usually difficult to separate because the shearing process causes the edges of the foil to stick together.

Given the above problems, it would be helpful if inexpensive household aluminum foil (rather than foil with a costly laminated plastic coating) could be provided in discrete sterile portions, and packaged in a manner that would maintain the sterility of these sheets while providing the laboratory worker rapid and convenient access

to this material. This is what the present invention is intended to accomplish.

Structurally, the aluminum foil cup that is described herein is adapted for use as a container cover, and has at least a bottom wall and a surrounding perimeter sidewall that is continuous with the bottom wall. The sidewall preferably includes upwardly oriented pleats. As explained above, multiple stacked cups are fabricated simultaneously using a shaped cup-forming tool and die, and a multi-sheet feeding process that delivers multiple sheets of aluminum foil that are interleaved with multiple sheets of paper liner (aka, interleaf sheets or paper release liner) preferably having a low coefficient of friction) to the die. Without use of the paper interleaf sheets, the die-cutting of stacked sheets of foil causes the edges of the foil to become entangled and difficult to separate from one another. The mechanical forming process involves applying substantial pressure and optionally heat to shape the cups, together with a die-cutting process that cleaves the cups from the multi-sheet feed.

The paper interleaves, i.e., separating sheets, are of a thickness sufficient to allow convenient handling of the foil (permitting easy physical separation of aluminum foil sheets) while not adding unnecessary cost to the product. Typically, paper interleaf sheets having a thickness of between 0.001 and 0.003 inches is suitable. The paper selected for this use is free of any contaminating material or additive that, during or after the foil converting

process (and during shelf storage), could move from the paper and contaminate the foil sheets (such as a vegetable oil). For example, a paper containing a small amount of wax, e.g. a microcrystalline wax, that remains in the paper and does not transfer to the foil may be a useful interleaf material, in which the wax is incorporated into paper pulp during its manufacture. The wax's lubricity can facilitate separation of the foil sheets from the paper interleaf.

Stacking of the interleaved foil cups also provides an economy in the packaging, sterilizing, shipping, and storage of product. Accordingly, a die-cut stack of foil cups with paper interleaf (e.g., 10-20 sheets of foil alternating with paper liner sheets) provides what is termed an assembly. One such assembly can be further stacked upon another to produce even larger assemblies containing 40, 60 or even several hundred foil cups following die-cutting. These larger assemblies are typically packaged, e.g., by thermoplastic shrink-wrapping, and then sterilized if the cups are to be used, or even occasionally used, as a sterile closure. Gamma irradiation of the plastic-wrapped assembly is a convenient sterilization method, since it sterilizes both the paper and the foil layers without significant heating and without use of a gaseous organic chemical.

Subsequently, in the laboratory, individual foil cups can be conveniently removed one at a time by hand from an assembly of stacked cups and used for whatever application is demanded. As suggested above, contamination of successive foil cups in a

stack is prevented by the presence of the disposable sterile paper interleaf sheets separating the foil sheets. In laboratory usage, foil cups are compliant, and can be manually shaped into coverings over laboratory container openings. Hand contact is limited to the outside surface of the foil to preserve interior sterility. Pleated foil cups also can be utilized as heat-resistant disposable containers, e.g., for incubation and drying purposes. Drying of chemical samples, filter papers, and other laboratory items can be conveniently accomplished in such cups.

Applicant is unaware of any prior art either in the patent literature, in scientific equipment catalogs or elsewhere relating to the presently invented pleated aluminum foil covers for laboratory containers. Applicant finds no suggestion in the literature that pleated foil structures can be adapted for use as laboratory container covers. On the worldwide web, numerous sites provide information on laboratory covering materials, but none suggest the use of a pleated foil cup as a re-shapeable container cover.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

The invention will be more fully described in the following detailed description in conjunction with the drawings in which:

FIG. 1 is a side view of the present invention in which a pleated foil cup (sterile or non-sterile) has been

inverted and placed over the mouth opening of an Erlenmeyer laboratory flask as a covering; and

FIG. 2 is another side view of the foil cup and laboratory flask depicted in Fig. 1 in which the sidewall of the foil cup has been squeezed inward to a friction fit around the neck of the flask.

DETAILED DESCRIPTION OF THE INVENTION

Definitions. As used in this description and the accompanying claims, the following terms shall have the meanings indicated, unless the context otherwise requires:

The phrase "covering the opening in a laboratory container" as used in the present invention means that the foil cup used in this regard, is inverted so that the interior of the cup is facing downward, and the cup is placed directly over the opening, i.e., mouth, of the container (regardless of whether the opening is the small mouth opening of a test tube, or the larger opening of a flask or beaker). The cup is selected to be of a sufficient size (diameter and sidewall height) so that the foil extends beyond the lip of the opening in the container and further extends downward along the neck or sidewall of the container at least 1/4 inch or so. Given the flexibility of the foil cup and its pleats, the cup may be extended in its diameter or alternatively compressed inward to provide a larger or smaller covering over the opening in the container. Selecting a suitable thickness for the

aluminum foil plays a critical role in the ability to re-shape the foil cup (see below).

The terms "heat-resistant and solvent-resistant" as used herein refers to the inherent properties of aluminum foil that are widely appreciated and generally known to laboratory workers, that allow the foil to be exposed to elevated temperatures, e.g., at least 300□C and to a wide variety of organic solvents without being damaged.

For the purposes of this invention, the term "aluminum foil" is defined as having a thickness of up to approximately 0.002 inches, (technically, as great as 0.00249 inches or 2.49 mils). A thickness of 2.50-3.49 mils is considered approximately 3 mils, by rounding. Foil having a 3 mil thickness is considered too great for use in the present invention. The aluminum foil has a sufficient thickness to be essentially free of pinholes produced before and/or after fabrication of the cup, while not being so thick that it is awkward or difficult to be easily re-shaped by a hand-squeeze around the neck opening or mouth of a container. Such re-shaping is a routine procedure with the use of aluminum foil in the household to cover a drinking glass, for example. Thus, foil having a thickness of less than 0.0003 inches (0.3 mils) is considered too fragile and susceptible to tearing and pin holes, while aluminum that is thicker than approximately 2.49 mils is considered too stiff for the intended use. For example, Applicant has found that laboratory weighing dishes (fabricated from aluminum sheet material) that are

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approximately 3 or 4 mils thick or thicker, are not sufficiently formable and re-shapeable to have utility in the present invention. In the present invention, the foil thickness has a fairly narrow range for ideal utility, i.e., between 0.5 mils and 1 mil thick.

The term "preformed" as used in the phrase "preformed aluminum foil cup" refers to any cup-like shape, e.g., dish, bowl or other open shaped container that has been fabricated and shaped from aluminum foil. The foil can be shaped not only by pleating the sidewall (see FIG. 1) to take up the extra foil present in the sidewall of the cup, but also using any other process that condenses or compacts the foil constituting the sidewall into a smaller area, e.g., by crinkling the foil or dimpling the foil. The cup must be of sufficient size (diameter and height) to cover the opening in the container, and be free of any substance that could contaminate the contents of the container that is being covered by the foil cup. The geometric requirements of the foil cup are that it has a "bottom wall" and a raised "perimeter sidewall" that extends upwardly from the bottom wall when the cup is resting on its bottom wall (oriented upward at an angle, for example, of 60-90 degrees). Furthermore, the perimeter sidewall is continuous with, and surrounds the bottom wall.

Depending upon the size of the cup, "multiple pleats" can mean 4 or 200 or any number of pleats in between. The flutes accommodate the surplus foil resulting from bending the foil upward to form a perimeter sidewall from a flat

sheet of foil. The pleats beneficially stiffen the sidewall of the cup.

The term "raised" or "upwardly oriented" with respect to the sidewall or pleats therein is meant to indicate a direction relative to the bottom wall of the cup.

The equipment required for manufacturing pleated foil cups is well known in the art. A mechanical forming die is fabricated consisting of male and female elements, preferably stainless steel. A combination of pressure and heat is applied to the elements of the die, thereby forming both the foil and the paper interleaves into the shape of the pleated cups. For efficiency, it is common practice for 10-30 sheets of paper and foil to be fed into the die at the same time, resulting in a nest or stack of cups that are separated and used one by one. The lubricity of the paper interleaves aids in separating the foil cups at the time of use.

Depending upon the container that is to be covered, the height of the perimeter sidewall that extends around the bottom wall of the foil cup can be varied by utilizing different dies. Preferred perimeter sidewall heights generally range between 0.25 inches and 2 inches.

The phrase "adjusting the shape and diameter of the cup so as to fit over the opening" means that a laboratory worker using finger pressure, can easily shape the foil cup around the container's neck or sidewall to achieve a friction fit over the container opening, whether the container is, for example, a beaker, a flask, a bottle, a

graduated cylinder, a test tube, a centrifuge tube, a cuvette, a vial, a scoop or any other vessel or implement in the laboratory that benefits from being covered by aluminum foil. The ability of aluminum foil to achieve a friction fit is attributable to its "dead-fold" property, i.e., once folded or creased, there is little to no tendency of foil to spring open, so that the foil remains in place even if the container is tilted

The term "friction fit" refers to the foil cup being squeezed, compressed or otherwise manually formed around the laboratory container opening so that it remains on the container. To the extent that foil tends to hold its "dead-folded" shape when compressed, the friction fit can be somewhat tighter or looser depending upon the intended use of the foil cover on the container.

The terms "radiation sterilization" and "gas sterilization" are well known laboratory methods, and typically involve exposing items to suitable doses of cobalt-60 isotope irradiation or alternatively ethylene oxide gas.

The phrase "free of any structural feature that would interfere with the use of said cup as a covering for a laboratory container" is a property met by an open cup, dish, tub, tray, cup, bowl, canister or similar structure formed from a flat sheet of aluminum foil, and that contains an area of foil sufficient to cover the mouth or other opening in a laboratory container.

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The term "lubricant" as it refers to a substance that could contaminate the foil cup (and nearby cups in a nested stack of cups) refers to lubricants such as vegetable oil, cocoa butter, and other substances that may be applied to the cup-forming die to reduce the incidence of torn foil during the fabrication process. While these lubricants may facilitate the manufacture of such cups, Applicant considers these lubricants to be contaminants if the cups are to be used as covers for containers holding pure chemical reagents. The foil surfaces must be chemically clean at the outset of manufacture, and these surfaces must remain clean as the cup undergoes fabrication.

The term "hermetically sealed" as used herein means that the items, e.g., the foil cups and interleaved paper liner sheets, originally placed inside a container that is sealed in this manner, will remain sterile and uncontaminated by microbial species, dust and chemical contaminants in the surrounding environment.

The term "assembly" as used herein, refers to a combination of two or more distinct physical elements that are needed in the invention for practical and functional reasons, and that are assembled or brought together in close proximity. In the present invention, two different assemblies are described, and these deal with two different combinations of elements.

One assembly consists of the aluminum foil cup and the laboratory container that have been united or assembled, as the foil cup has been placed over the container and shaped

to a friction fit on the container, e.g., around the neck of an Erlenmeyer flask (se FIG. 1).

The other assembly refers to a nested stack of foil cups with interleaved sheets of liner paper between each successive cup in the stack. This assembly is created in the process of manufacturing the cups. Rendering this assembly sterile produces a uniquely useful product for research and clinical laboratory use, in which each successive sterile layer (paper or foil layer) in the assembly protects the next sterile layer. For practical reasons (to preserve sterility of the product during storage and shipping of the sterile cups) the assembly of stacked cups is hermetically sealed in a container selected from the group consisting of a container with reclosable lid, a reclosable plastic bag, and a shrink-wrapped plastic film. So that the interior surfaces of the sealing container are also sterile, it is advisable that the stacked foil cups are sealed in the container prior to sterilization.

Referring to the drawing, a generally round and pleated aluminum foil cup 10 (in the example shown, approximately 2.5 inches in diameter and 0.75 inches in height) has been previously manufactured and used as a small baking cup. As described herein, the foil cup is preferably manufactured without any lubricants on the tooling that could contaminate the surfaces of the cup. Before contacting the Erlenmeyer flask shown in Fig. 1, the foil cup is inverted (bottom side up), so that it may serve

as a covering for this laboratory container. As described elsewhere herein, foil cup 10 is formed and die-cut by a tool and die assembly (not shown) that exerts pressure (and optionally heat) to alternating interleaved sheets of aluminum foil and a release liner paper that are fed into the tool and die assembly. Foil cup 10 includes a bottom wall 12 that is substantially planar and round, and a perimeter sidewall 14 that is continuous with, surrounds, and extends upwardly from bottom wall 12. Perimeter sidewall 14 includes flutes or pleats that are generally oriented upward, i.e., up and down rather than horizontally. Each of these flutes when viewed from the exterior of foil cup 10 is composed of a convex portion 16 and a concave portion 18. These portions alternate around the foil cup 10. Erlenmeyer flask 20 is composed of a body portion 22, and neck portion, 24. The neck portion 24 extends upward to lip 26 that surrounds the mouth opening 28 (also termed neck opening) of the flask. Foil cup 10 is initially placed over mouth opening 28, lip 26 and a part of the neck portion 24 (Fig. 1). The outside surface including sidewall 14 of foil cup 10 is then compressed and crumpled inward (using ones hand) against the neck portion 24 to produce a friction fit around this neck portion 24 (Fig. 2).

Thus in a first aspect, the invention features a method of covering the opening in a laboratory container such as a beaker, flask, graduated cylinder or test tube with aluminum foil to provide a heat-resistant and solvent-

resistant closure. The method includes the steps of: (i) providing a preformed aluminum foil cup of sufficient size to cover the container opening, in which the cup is free of any substance that could contaminate the contents of the container, and in which the cup includes a bottom wall and a raised perimeter sidewall that is continuous with, and surrounding this bottom wall, in which the perimeter sidewall includes a multiplicity of upwardly oriented flutes; (ii) inverting and placing this inverted cup over the container opening; (iii) optionally adjusting the shape and diameter of the cup so as to fit over the opening; and (iv) squeezing the sidewall of the cup to a friction fit around the opening, neck opening or mouth of the container.

In one embodiment, the aluminum foil cup is sterile because it has been pre-sterilized.

In a related embodiment the cup has been sterilized by a process selected from the group consisting of radiation sterilization and gas sterilization.

In another embodiment, the aluminum foil used to fabricate the cup is between 0.0005 inches and 0.005 inches thick.

In a preferred embodiment, the aluminum foil is between 0.0005 and 0.002 inches thick.

In another embodiment, the fabrication of the cup is carried out using a mechanical forming die that utilizes a forming means selected from the group consisting of pressure, heat, and a combination thereof.

In still another embodiment, the surface geometry of the sidewall of the foil cup is selected from the group including pleated, fluted, crinkled and dimpled.

In yet another preferred embodiment, the cup is an open dish-shaped structure selected from the group consisting of tubs, trays, cups, bowls, canisters and other vessels that are free of any structural feature that would interfere with the use of the cup as a cover for a laboratory container opening.

In another embodiment, the length measured across the largest dimension of the bottom wall of the cup is between 1 inch and 6 inches.

In a preferred embodiment, this aforementioned length is between 1 inch and 3 inches.

In another embodiment, the height of the perimeter wall of the cup is between 0.25 inches and 2.5 inches.

In a preferred embodiment, the aforementioned height is between 0.5 inches and 1.5 inch.

In another preferred embodiment, the foil cup is manufactured without using any substance that could contaminate the cup and nearby cups in a nested stack of cups that are manufactured at the same time.

In yet another embodiment the container is selected from the group of laboratory containers that include beakers, flasks, bottles, graduated cylinders, test tubes, centrifuge tubes, cuvettes, vials, scoops and the like.

In another aspect, the invention features a sterile assembly that includes a multiplicity of stacked sterile

aluminum foil cups whose length as measured across the largest dimension of the bottom wall of the cups is between 1 inch and 6 inches, in which the cups are fabricated from aluminum foil that is between 0.0005 inches and 0.005 inches thick , and each of said cups is interleaved with a removable sterile paper liner sheet that allows the cups to be manually handled, separated from one another, and/or retrieved from the stack one at a time together with the paper liner sheet that protects the inside surface of the cup from becoming contaminated.

In a preferred embodiment, the above assembly is hermetically sealed in a container for storage and shipping to assure the integrity of the stacked cups and interleaved paper sheets, and continued sterility of these items. The sterilization, e.g., by radiation, can be conveniently carried out after the assembly has been sealed in a container.

In one embodiment, the container used for sealing the assembly is selected from the group consisting of a container with reclosable lid, a reclosable plastic bag, and a shrink-wrapped plastic film.

In a preferred embodiment, the hermetically sealed assembly has been radiation sterilized.

In still another aspect, the invention features an assembly that includes a laboratory container covered by the aluminum foil cup described above.

In one embodiment, this assembly has been sterilized. Autoclaving or oven baking are useful alternative methods for sterilizing this assembly.

All patents and publications mentioned in the specification are indicative of the levels of skill of those skilled in the art to which the invention pertains. All references cited in this disclosure are incorporated by reference to the same extent as if each reference had been incorporated by reference in its entirety individually.

One skilled in the art would readily appreciate that the present invention is well adapted to carry out the objects and obtain the ends and advantages mentioned, as well as those inherent therein. The specific methods and compositions described herein as presently representative of preferred embodiments are exemplary and are not intended as limitations on the scope of the invention. Changes therein and other uses will occur to those skilled in the art which are encompassed within the spirit of the invention are defined by the scope of the claims.

It will be readily apparent to one skilled in the art that varying substitutions and modifications may be made to the invention disclosed herein without departing from the scope and spirit of the invention. For example, those skilled in the art will recognize that the invention may suitably be practiced using any of a variety of aluminum foil materials, e.g., using regular household, heavy duty, or industrial aluminum foils to fabricate the foil cups, as well as any one of a variety of cup shapes, sizes and

contours besides a simple round cup-cake or muffin-sized pleated foil cup that is approximately 2.5 inches in diameter. Likewise, any of a wide variety of laboratory containers, implements, instruments, and the like may be covered by the foil cups described herein.

The invention illustratively described herein may be suitably practiced in the absence of any element or elements, limitation or limitations which is not specifically disclosed herein. Thus, for example, in each instance herein any of the terms "comprising," "consisting essentially of" and "consisting of" may be replaced with either of the other two terms. The terms and expressions which have been employed are used as terms of description and not of limitation, and there is not intention that in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed. Thus, it should be understood that although the present invention has been specifically disclosed by preferred embodiments and optional features, modification and variation of the concepts herein disclosed may be resorted to by those skilled in the art, and that such modifications and variations are considered to be within the scope of this invention as defined by the appended claims.

In addition, where features or aspects of the invention are described in terms of Markush groups or other grouping of alternatives, those skilled in the art will

recognize that the invention is also thereby described in terms of any individual member or subgroup of members of the Markush group or other group. For example, if there are alternatives A, B, and C, all of the following possibilities are included: A separately, B separately, C separately, A and B, A and C, B and C, and A and B and C. Thus, the embodiments expressly include any subset or subgroup of those alternatives, for example, any subset of the shapes of cups may be used for the stated purpose. While each such subset or subgroup could be listed separately, for the sake of brevity, such a listing is replaced by the present description.

While certain embodiments and examples have been used to describe the present invention, many variations are possible and are within the spirit and scope of the invention. Such variations will be apparent to those skilled in the art upon inspection of the specification and claims herein. Other embodiments are within the following claims.